

BURMANNIACEAE (F. P. Jonker, Utrecht)

Annual or perennial, saprophytic or autotrophic herbs; the saprophytic species often colourless. *Leaves* usually spread or alternate, entire, simple, without stipules; non-saprophytic species with a radical rosette of linear leaves; stem leaves often reduced to small scales; sometimes the basal part of the stem provided with many decurrent, grass-like leaves. *Flowers* ♂, usually actinomorphic, solitary or in capitate or cymose inflorescences. Perianth corolline; limb consisting of 2 whorls; tube sometimes 3-winged. Anthers 3, subsessile in the perianth throat and dehiscing laterally with horizontal slits, or 6, hanging down in the perianth tube and dehiscing with longitudinal slits. Connective large, often appendiculate. Style filiform or shortly cylindrical or conical. Stigmas 3, sometimes connate. Ovary inferior, 1-celled with parietal placentation, or 3-celled with axile placentation. Ovules ∞, anatropous, with 2 integuments; funicles often rather long. *Fruit* usually capsular, sometimes fleshy, crowned by the persistent perianth tube and the style, or by a thickened persistent basal ring of the perianth tube, dehiscing irregularly or with transverse slits at the top. Seeds ∞, small, subglobose to linear, sometimes with loose, reticulate testa, with endosperm.

Distr. About 125 species, widely distributed in the tropics of both hemispheres, also in subtropical America, Chicago area, Mozambique, Southern China, Japan, Southern Australia, New Zealand and Tasmania. As many species are rare, it is possible that only a part of their area is known. Most of them are found in moist regions. Among the autotrophic Malaysian *Burmanniaceae* there are 3 rather common species which are widely spread, viz *Burmannia coelestis*, *B. disticha* and *B. longifolia*. The latter two are absent from Java and the Lesser Sunda Islands, the former occurs in Java proper only in its western part. Of the saprophytic Malaysian species only 3 have been often collected, viz *Burmannia championii*, *B. lutescens*, and *Gymnosiphon affinis*.

Ecol. The autotrophic species provided with green leaves occur in grass-fields, along road sides and river-banks, among brush-wood and in forests or on moist swampy soil, up to about 3000 m alt. The saprophytic species usually occur in dense primary or secondary forests on soils rich in humic matter by decaying wood and leaves, up to ca 1500 m alt. They are also found sometimes in bamboo bushes and parks.

Notes. Treatment mostly after JONKER, A monograph of the Burmanniaceae, Thesis, Utrecht, 1938; also in: Meded. Bot. Mus. & Herb. Utrecht no 51; slightly revised.

In collecting *Burmanniaceae* it is necessary to collect plants with complete flowers, as the limb with the stigmas and stamens is often caducous. The fruits are also important. The colour of the flowers, stems and leaves must be noted. Preservation of collections in 60% spirits is recommended.

In the field the saprophytic species are often found in colonies together with other saprophytic plants belonging to the *Orchidaceae*, *Triuridaceae*, and *Gentianaceae*. From the extreme rarity of a number of species it may be assumed that by further collecting these tiny plants several novelties will be found.

KEY TO THE GENERA

1. Perianth tube cylindrical or trigonous, persistent on the capsule. Style of equal length as the tube. Anthers 3, subsessile in the perianth throat. Thecae dehiscing laterally with transverse slits
TRIBE *Burmannieae* MIERS
2. Ovary and capsule 3-celled with axile placentation. Perianth as a whole persistent on the capsule. Ovary and perianth often prominently 3-winged, sometimes 3-costate or wingless. Ovary without glands. Capsule mostly dehiscing irregularly 1. *Burmannia*
2. Ovary and capsule 1-celled with parietal placentation. Perianth limb with the stamens and stigmas deciduous. Ovary and perianth wingless. Both sides of the top of each placenta inside the ovary provided with a gland. Capsule reticulate-perforated 2. *Gymnosiphon*
1. Perianth tube urceolate, circumscissile, only a small basal ring persistent on the fruit. Style very short, cylindrical or conical. Anthers 6, hanging down in the tube. Thecae dehiscing introrsely with longitudinal slits
TRIBE *Thismieae* MIERS
3. Inner perianth lobes free, or converging at their tops or connate to a mitre with 3 holes, the latter without appendages at the apex 3. *Thismia*
3. Inner perianth lobes connate to a mitre with 3 holes, crowned by 1 or 3 appendages.
4. Mitre crowned by 3 erect, thick, filiform appendages, clavately swollen at their tops . . . 4. *Geomitra*
4. Mitre crowned by 1 erect thick column, bearing at its apex 3, more or less connate, glandular lobes 5. *Scaphiophora*



Fig. 1-8. Burmanniaceae. 1. *Burmannia bifaria* J. J. S., $\times \frac{1}{1}$, 2. *Scaphiophora gigantea* JONK., $\times \frac{1}{3}$, 3. *Thismia aseroe* BECC., $\times \frac{3}{5}$, 4. *Th. episcopalis* (BECC.) F. V. M., $\times \frac{2}{3}$, 5. *Burmannia coelestis* DON, $\times \frac{3}{2}$, 6. *Burmannia championii* THW., $\times \frac{1}{1}$, 7. *Gymnosiphon aphyllus* BL., $\times \frac{2}{3}$, 8. *Burmannia longifolia* BECC., $\times \frac{2}{5}$.

I. BURMANNIA

LINNÉ, Sp. Pl. ed. 1 (1753) 287; JONKER, Monogr. (1938) 18, 57.

Annual or perennial, saprophytic and colourless or chlorophyllose. Flowers often 3-winged. *Perianth* limb usually consisting of 6 lobes; the outer ones being much larger; inner 3 often minute, sometimes lacking. *Perianth* tube cylindrical to trigonous. Anthers 3; connective sometimes with 2 apical crests and/or a hanging, median, basal spur. Style filiform, branching into 3 short branches, each bearing a stigma, or 3 sessile stigmas at the apex of the style. Ovary trigonous. *Fruit* capsular, mostly dehiscent irregularly. Seeds many, oblong or ellipsoid.

Distr. 57 species, tropics of both hemispheres, also in the S. United States, S. part of S. America Moçambique, S. China, Japan and S. Australia.

KEY TO THE SPECIES

1. Perennial, leafy green herbs. Greater part of the stem beset with grass-like, linear or ensiform, decurrent, imbricate leaves. Inflorescence usually many-flowered. Flowers hanging, very narrowly 3-winged in the basal part (SECT. *Foliosa* JONK.). 1. *B. longifolia*
1. Annual or perennial, saprophytic or green herbs. Stem leaves reduced to small scales. The non-saprophytic species with a radical rosette of linear leaves. Stem usually 1- to few-flowered. Flowers erect (SECT. *Euburmannia* MALME)
2. Non-saprophytic, chlorophyllose herbs with a rosette of green leaves at the base; rosette often consisting of only 1-3 leaves.
3. Flower wings narrower than the perianth tube or reduced to ribs.
4. Basal rosulate leaves few. Stem bearing 1-2 flowers at its apex. Connective with 2 apical crests, basal spur lacking. Ovary as long as the perianth or longer 2. *B. geelvinkiana*
4. Basal rosette well developed. Stem bearing at its apex a usually bifid inflorescence. Connective provided with 2 apical crests and a basal, hanging spur. Ovary shorter than the perianth 3. *B. bancana*
3. Flower wings as wide as the perianth tube or wider.
5. Margin of the perianth lobes double. Connective with a basal hanging spur and 2 apical crests. Thecae separated.
6. Robust herbs with a well developed rosette of grass-like, up to 15 cm long leaves. Inflorescence usually a bifid, many-flowered cyme 4. *B. disticha*
6. Slender herbs. Basal rosulate leaves about 1 cm. Stem bearing at its apex a single flower or a cluster of few flowers 5. *B. coelestis*
5. Perianth lobes with single margin. Connective with 2 apical crests; basal spur lacking. Thecae connate below the basal connective margin 6. *B. connata*
2. Saprophytic herbs without chlorophyll. Radical rosette absent.
7. Flowers wingless, 3- or 6-costate.
8. Stem scales many, imbricate in the lower part of the stem. Ovary as long as the perianth or longer 7. *B. sphagnoides*
8. Stem scales not imbricate. Ovary shorter than the perianth.
9. Flowers 6-costate. Perianth limb thick, fleshy, more or less succulent 8. *B. bifaria*
9. Flowers 3-costate to narrowly 3-winged. Limb not fleshy.
10. Inflorescence usually capitate. Inner perianth lobes spatulate, sometimes slightly papillose. Connective mucronate at the apex, obtuse at the base 9. *B. championii*
10. Flowers usually pedicellate. Inner perianth lobes broadly obovate, distinctly papillose. Connective not mucronate, acute at the base 10. *B. micropetala*
7. Flowers 3-winged.
11. Inner perianth lobes absent.
12. Perianth lobes simple. Connective with an apical, papillose crest and a basal, hanging, obtuse spur 11. *B. tridentata*
12. Perianth lobes bifid. Connective without crest and spur 12. *B. oblonga*
11. Inner perianth lobes not lacking, sometimes very small.
13. Very delicate plants. Connective with a basal, hanging spur 13. *B. steenisii*
13. Plants not very delicate. Connective without basal, hanging spur.
14. Stem rather robust, often many-flowered. Inner perianth lobes minute, orbicular. Flower wings variable, linear to half cuneate or quadrangular 14. *B. lutescens*
14. Slender herbs, usually 1-flowered. Inner perianth lobes lanceolate. Flower wings elliptical 15. *B. malasica*

1. *Burmattia longifolia* BECC. Malesia 1 (1877) 244; JONKER, Monogr. (1938) 20, 59.—*B. leucantha* SCHLTR. Bot. Jahrb. 49 (1913) 107.—Fig. 8.

Perennial, 12–50 cm. Stem usually simple, forked at the top into the bifid inflorescence or bearing a simple cincinnus. *Leaves* linear, sometimes keeled, decurrent, stem-clasping, acute, sometimes subulate, parallel-veined but midrib more prominent, growing smaller towards the top, 4–20 cm by 2–9 mm. Upper part of stem beset with appressed, scattered, lanceolate, acute scales, 5–33 mm. Basal part of stem with brownish, dried leaves. Inflorescence 32–1-flowered, branches up to 4 cm. Bracts scale-like, linear-lanceolate, 5–10 mm. *Flowers* subsessile, hanging, white, often with pale-violet or bluish limb, 8–16 mm. Outer perianth lobes deltoid, acute, 2–4½ mm; margin fleshy at the base. Inner ones broad-obovate to orbiculate, entire and rounded, or retuse, or bilobate, 1½–2 mm. Perianth tube cylindrical, sometimes swollen in the upper part, 3–5 mm; lower part of tube and ovary very narrowly 3-winged. Stamens inserted just below the inner perianth lobes. Connective broad, oblong, crowned by two, rather wide crests. Filaments short, broad. Style thick, branching into 3 very short branches, each bearing a curved funnel-shaped stigma. Ovary obovoid, 4–7 mm. *Capsule* obovoid, dehiscing transversally, irregularly. Seeds oblong to scobiform, appendaged at both sides; testa loose, reticulate.

Distr. All over *Malaysia*, except Java and the Lesser Sunda Islands.

Ecol. In mountain forests, brush-wood, along mossy trails, often on ridges, scattered, ascending to 2800 m alt.

2. *Burmattia geelvinkiana* BECC. Malesia 1 (1877) 244; JONKER, Monogr. (1938) 111.

Annual, 7–12 cm. Stem filiform, simple, bearing 1 or, sometimes, 2 flowers. Rosulate *leaves* 2–5, linear, subulate, 3-nerved, 3–5 mm by 1 mm. Stem leaves scale-like, appressed, linear-lanceolate, acuminate to subulate, up to 3 mm. Bracts ovate-lanceolate, long-acuminate, 3-nerved, 1½ mm. *Flowers* bluish, very narrowly 3-winged, 7 mm. Outer perianth lobes triangular to broad-ovate, apiculate, about 1½ mm. Inner ones linear, obtuse, ½–1 mm. Connective thick, triangular, obtuse at the base, bearing two divergent, slightly papillose crests at the apex. Style rather short and thick, bearing 3 sessile, funnel-shaped stigmas; style with stigmas about 1½ mm. Ovary ellipsoid to narrowly obovoid, about 4 mm. Flower wings linear, about 5½ mm by ¼ mm. *Capsule* obovoid, dehiscing with transverse slits. Seeds ovoid, bright yellow.

Distr. *Malaysia*: West New Guinea (Wandamen Peninsula, Geelvink Bay), once collected.

3. *Burmattia bancana* MIQ. Fl. Ind. Bat. Suppl. 1 (1860) 617; JONKER, Monogr. (1938) 24, 113.—*B. graminifolia* WARB. in FEDDE, Rep. 18 (1922) 330.

Annual, 20–37 cm. Stem simple, terete, forked into the inflorescence. Rosette distinct; *leaves* many, linear to lanceolate, subulate, parallel-veined, 2½–7 cm by 6 mm. Stem leaves few, scale-like, ap-

pressed, lanceolate, subulate, 1–3 cm. One rosette sometimes bearing 2 or 3 stems. Inflorescence a double cincinnus, 3- to 5-flowered; branches up to 3 cm. *Flowers* blue or purplish, narrowly winged, 6–13 mm. Outer perianth lobes lanceolate-triangular, acute, with 3 prominent, fleshy nerves inside, up to 3 mm. Inner ones linear-lanceolate, obtuse, up to 2½ mm; midrib prominent, fleshy. Perianth tube cylindrical-trigonous, up to 4½ mm. Connective oblong, provided with a basal, hanging, obtuse spur and 2 apical, divergent obtuse crests. Style filiform, branching into 3 short branches, each bearing a slightly curved, funnel-shaped stigma. Ovary truncate-ellipsoid, 3–7 mm. Flower wings linear, 11 by ½–1 mm. *Capsule* ellipsoid to obovoid. Testa of the seeds elongate.

Distr. *Malaysia*: Sumatra, Banka, Billiton, Borneo.

Ecol. Wet places, along streams, &c.

Vern. *Roempoeet taroem, oemboet oemboet* (Billiton).

4. *Burmattia disticha* LINNÉ, Spec. Plant. 1 (1753) 287; JONKER, Monogr. (1938) 115.—*B. distachya* R. Br. Prod. Fl. Nov. Holl. 1 (1810) 265.—*B. sumatrana* MIQ. Fl. Ind. Bat. Suppl. 1 (1860) 616.—*B. disticha* var. *sumatrana* Hook. f. Fl. Br. Ind. 5 (1888) 664.

Robust annual, up to 75 cm. Stem usually simple, forked into the inflorescence. Rosette distinct; *leaves* linear or lanceolate, acute, up to 15 cm by 13 mm. Stem leaves reduced to appressed, lanceolate, acute or acuminate scales, up to 7 cm by 7 mm, imbricate in the lower part of stem; upper part of stem often leafless. Inflorescence branches up to 8 cm. Bracts lanceolate, acute, about 5–12 mm. *Flowers* sessile or shortly pedicellate, blue or purplish, often with yellow-tipped, greenish lobes, rarely yellow, 10–20 mm. Outer perianth lobes triangular, acute, 2½ mm; margin thick, double in the basal part. Inner lobes linear-lanceolate, fleshy, obtuse, 1–1½ mm. Perianth tube cylindrical-trigonous, 3–4½ mm. Connective broad, provided with 2 distinct, acute apical crests and a broad, obtuse to almost truncate, basal, hanging spur. Style thick-filiform, bearing 3 sessile, funnel-shaped stigmas; style with stigmas about 3 mm. Ovary ellipsoid to obovoid, truncate, attenuate towards the base, up to 1 cm. Flower wings elliptical, 10–18 by 1½–2½ mm, continuing as crests on the back of the outer perianth lobes, decurrent along the short pedicel. *Capsule* obovoid, truncate, irregularly dehiscing with transverse slits.

Distr. Widely distributed in the tropics of Asia and Australia: Ceylon, India, Siam, Indo-China, China, through *Malaysia* to Australia, in *Malaysia* hitherto not found in Java, the Lesser Sunda Islands, Moluccas, and Philippines.

Ecol. A species with a large ecological amplitude. It has been collected in brush-wood, swamps and bogs among *Sphagna*, moist hollows, open grasslands, mountain meadows, marshy plateaus, on bare rocks, and has even been recorded as growing in water; ascending to ca 3500 m alt.

Vern. *Si goeroe goeroe* (Sumatra).

5. *Burmanna coelestis* DON, Prod. Fl. Nep. (1825) 44; JONKER, Monogr. (1938) 120.—*B. javanica* BL. Enum. Fl. Jav. 1 (1827) 28.—*B. triflora* RONB. Fl. Ind. 2 (1832) 117.—*B. azurea* GRIFF. Not. 3 (1851) 326.—*B. selebica* BECC. Malesia 1 (1877) 243.—*B. borneensis*, *B. chinensis*, *B. malaccensis* & *B. rigida* GANDOG. Bull. Soc. Bot. Fr. 66 (1919) 290.—Fig. 5.

Autotrophic annual, up to 30 cm. Stem simple or, sometimes, branched, bearing a single flower or a cluster of few flowers. Rosulate leaves linear or lanceolate, acute or acuminate, 3-nerved, about 1 cm by $1\frac{1}{2}$ –3 mm. Stem leaves appressed, imbricate in the basal part, linear-lanceolate, subulate, rather long, up to 2 cm. Bracts lanceolate, acute, 4 by 1 mm. Flowers prominently 3-winged, blue, purplish or white, often with yellow lobes, about $1\frac{1}{2}$ mm. Outer perianth lobes ovate, apiculate, with double margin, about $1\frac{1}{2}$ mm. Inner ones lanceolate, apiculate, with double margin, about $\frac{1}{2}$ mm. Tube cylindrical-trigonous, about 5 mm. Connective provided with 2 apical, divergent, obtuse to truncate crests and a basal hanging, rather long, obtuse spur. Style thick-filiform, bearing 3 sessile, funnel-shaped stigmas with swollen margin. Style with stigmas about 4 mm. Ovary ellipsoid to obovoid, truncate, attenuate towards the base, about 5 mm. Flower wings half elliptical to half obovate, about 10 by $2\frac{1}{2}$ mm. Capsule obovoid, truncate, transversely dehiscent.

Distr. Widely spread in tropical Asia: India, Siam, Indo-China, S. China, and the Caroline Islands, in Malaysia throughout the Archipelago, in Java only in the W. part, once collected in the S. part of Madoera Island, and once in Bali, otherwise absent from the Lesser Sunda Islands.

Ecol. Grass-fields, among alang-alang (*Imperata*), in mountain meadows, parks and plantations, ascending to ca 1700 m alt.

6. *Burmanna connata* JONKER, Monogr. (1938) 128.

Autotrophic annual, 15–30 cm. Stem simple, bearing 1–3, shortly pedicellate flowers. Rosulate leaves few, linear, acute or acuminate, 1-nerved, 4–8 by 1 mm. Stem leaves scale-like, appressed, linear, acute, 2–5 mm. Bracts linear-lanceolate, acute, $1\frac{1}{2}$ mm. Flowers prominently 3-winged, 6–8 mm. Outer perianth lobes acute, with involute margin, 1 mm. Inner ones broadly ovate, obtuse, nearly $\frac{1}{2}$ mm long. Perianth tube cylindrical, 3 mm. Connective rather broad, provided with 2 apical, divergent, obtuse crests. Thecae bright yellow, appressed against the connective and connate below the basal connective margin. Basal hanging spur lacking. Style as long as the tube, branching into 3 short branches, each bearing a peltate, disk-shaped stigma. Ovary ellipsoid to obconical, $2\frac{1}{2}$ –4 mm. Flower wings half oblanceolate, decurrent along the pedicel, 8 by 2 mm. Capsule ellipsoid, dehiscent with transverse slits, 4–6 mm. Seeds scobiform, yellow.

Distr. Malaysia: Sumatra, Eastcoast Residency (Kota Pinang, Soengei Kana).

7. *Burmanna sphagnoides* BECC. Malesia 1 (1877) 246; JONKER, Monogr. (1938) 135.

Saprophyte, $4\frac{1}{2}$ –12 cm. Stem simple, thick, beset with many lanceolate, acute, in the lower part imbricate, 3–6 mm long, scale-like leaves and bearing 2–5 subsessile flowers at the apex. Bracts broad-lanceolate to ovate, acute, 3–6 mm. Flowers 6-costate, white, about $8\frac{1}{2}$ mm. Outer perianth lobes broadly triangular, with swollen margin, about $8\frac{1}{2}$ mm. Inner ones fleshy, obtuse to rounded, papillose, almost 1 mm. Perianth tube cylindrical, about 2 mm. Connective oblong, acute at the base crowned by 2 divergent, obtuse crests. Style thick-filiform, bearing 3 sessile, obconical stigmas. Ovary large, broadly ellipsoid to subglobose, 4–5 mm.

Distr. Malaysia: Malay Peninsula, Sumatra (Eastcoast Res.), and Borneo (Sarawak).

Ecol. A rare species, occurring in decaying matter in forests.

8. *Burmanna bifaria* J.J.S. Icon. Bogor. 4 (1914) 379; JONKER, Monogr. (1938) 136.—*B. engganensis* JONKER, Blumea 3 (1938) 108; Monogr. (1938) 137.—Fig. 1.

Saprophyte, 5–13 cm. Stem simple or branched, beset with scale-like, ovate to lanceolate, 1-nerved, sometimes distichous, up to 5 mm long leaves and bearing 1 flower or branching into a bifid, up to 9-flowered cyme. Flowers shortly pedicellate, 6-costate, white or somewhat purplish, 9–13 mm. Limb fleshy. Outer perianth lobes triangular, obtuse, with involute, crenate margin, $1\frac{1}{2}$ –2 mm. Inner ones ovate to orbicular, $\frac{1}{4}$ – $1\frac{1}{2}$ mm. Perianth tube cylindrical-trigonous, $2\frac{1}{2}$ –5 mm. Connective obtriangular, crowned by 2 divergent, papillose crests. Style thick-filiform, branching into 3 short branches, each bearing a somewhat funnel-shaped stigma with a broad, rotundate, membranous, hanging appendage. Style with stigmas 4– $4\frac{1}{2}$ mm. Ovary ellipsoid, 3–6 mm. Seeds ovoid, brown. Flower wings reduced to narrow, linear ribs.

Distr. Malaysia: West Java (vicinity of Buitenzorg) and Enggana Island (off SW. Sumatra).

Ecol. Among decaying leaves in forests, ascending to 1000 m alt.

9. *Burmanna championii* THW. Enum. Pl. Zeyl. (1864) 325; JONKER, Monogr. (1938) 138.—*B. tuberosa* BECC. Malesia 1 (1877) 245.—*B. capitata* (non MART.) MAKINO, Bot. Mag. Tok. 4 (1890) 23.—*B. japonica* MAXIM. ex MAK. Ill. Fl. Jap. 1, no 7 (1891) 4.—*B. dalzielii* RENDLE, Journ. Bot. 40 (1902) 311.—*B. chionantha* SCHLTR. Bot. Jahrb. 49 (1913) 107.—Fig. 6.

Saprophyte, 2–18 cm. Rhizome tuberous or elongate, covered with hair-like roots, producing small, adventitious tubers. Stem simple, beset with lanceolate, acute, appressed, scale-like, $1\frac{1}{2}$ –4 mm long leaves. Bracts lanceolate, acute, about 3 mm. Flowers subsessile in a capitate inflorescence at the top of the stem, 3-costate, white, 5–12 mm. Outer perianth lobes triangular, acute, with involute margin in the upper part, 1– $2\frac{1}{2}$ mm. Inner ones spatulate, rounded, slightly papillose at the margin, about $\frac{3}{4}$ mm. Connective broadly oblong, obtuse at the base, crowned by 2 indistinct, divergent, obtuse crests and provided with a median small

point at the apex, usually directed inwards and then hardly perceptible. Style thick-filiform, bearing 3 subsessile funnel-shaped stigmas; style with stigmas 3 mm. Ovary ellipsoid to obovoid, 2-3 mm.



Fig. 9. *Burmannia lutescens* BECC., with broad wings (Mt Gedeh, W. Java), $\times 1/1$.

Distr. Ceylon, S. China, Japan and *Malaysia*: Batoe Islands (off W. Sumatra), Banka, W. Java, Borneo, and New Guinea.

Ecol. A species with a large ecological amplitude, occurring in humus of moist forests and also in parks, plantations, bamboo bush, on rocks in streams.

10. *Burmannia micropetala* RIDL. Trans. Linn. Soc. II, 9 (1916) 228; JONKER, Monogr. (1938) 140.

Saprophyte, 7 $1/2$ -15 cm. Stem simple, beset with acute or acuminate, 1-nerved, often keeled, 2-5 mm long, scale-like *leaves*. Bracts linear-lanceolate, acute, 1-nerved, about 4 mm. Pedicels up to 5 mm. *Flowers* shortly pedicellate, in contracted 3-8-flowered bifid or, sometimes, pseudo-umbellate cymes, very narrowly 3-winged to 3-costate, 7-9 mm. Outer perianth lobes triangular, acute,

about 2 mm, in the upper part provided with small, rounded, crenate lateral lobes. Inner ones broadly obovate, rounded, papillose at the margin, 1 $1/2$ mm. Perianth tube cylindrical, about 3 mm. Connective oblong, acute at the base, crowned by 2 divergent, acute crests. Style thick-filiform, branching at the apex into 3 very short branches, each bearing a funnel-shaped stigma with 2 small, apical points. Style with stigmas about 3 mm. Ovary ellipsoid, truncate, about 2 $1/2$ mm.

Distr. *Malaysia*: New Guinea only.

11. *Burmannia tridentata* BECC. *Malesia* 1 (1877) 246; JONKER, Monogr. (1938) 141.

Saprophyte, 6-14 cm. Stem simple or branched, beset with appressed, lanceolate, acute, 1-veined, slightly keeled, scale-like, 1 $1/2$ -2 mm long *leaves*. Bracts ovate-lanceolate, acuminate, 1-veined, about 1 $1/2$ mm. Stem or branches bearing 1-3, prominently winged, 2-7 mm long *flowers*. Outer perianth lobes triangular to ovate, obtuse, swollen at the margin, 1-1 $1/2$ mm. Inner lobes absent. Perianth tube cylindrical, about 2 mm. Connective quadrangular with a broad, swollen, obtuse, hanging, basal spur, and an apical, erect, papillose, obtuse crest. Style as long as the tube, bearing 3 subsessile, funnel-shaped stigmas. Ovary subglobose, about 2 mm. Flower wings half elliptical to half-orbicular, about 4 by 2 mm. *Capsule* subglobose, about 2 $1/2$ mm. Seeds scobiform.

Distr. *Malaysia*: Borneo, Sarawak (Mt Matang), once collected.

12. *Burmannia oblonga* RIDL. J. Str. Br. R. As. Soc. 41 (1904) 33; JONKER, Monogr. (1938) 25, 142.—*B. bifida* GAGNEP. Bull. Soc. Bot. Fr. 54 (1907) 462.

Saprophyte, 7-15 cm. Stem simple or branched, bearing 1-2 flowers, beset with appressed, ovate to lanceolate, obtuse, scale-like, about 1 $1/2$ mm long *leaves*. Below the flower 2 lanceolate, scale-like bracts, 2 $1/2$ mm. *Flowers* white, sometimes with yellow limb, 8-10 mm. Outer perianth lobes bifid, obtuse, about 1 $1/2$ mm, papillose in the upper half at the margin, in the lower half with 2 yellow bags inside, provided with 2 involute, narrow triangular lateral lobes. Inner ones absent. Tube conical, 4-4 $1/2$ mm long. Connective oblong, yellow, without crests or spur. Style thick-filiform, bearing at the apex 3 sessile, funnel-shaped curved stigmas. Style with stigmas about 4 $1/2$ mm. Ovary subglobose, 2 $1/2$ -4 mm. Flower wings obovate, truncate, white, 5-7 $1/2$ by 3-4 mm.

Distr. Hainan, Indo-China and *Malaysia*: Malay Peninsula, N. Sumatra (Atjeh and Eastcoast Res.).

Ecol. On forested rocks or loamy soil in dense jungle or forest, ascending to 1300 m.

13. *Burmannia steenisii* JONKER, Monogr. (1938) 158.

Delicate saprophyte, 2-6 cm. Stem simple or branched, bearing 1-2 flowers, beset with lanceolate, acute, scale-like, 1 $1/2$ -1 $1/2$ mm long *leaves*. Below each flower 1 or 2 lanceolate, 1-veined, acute bracts, about 1 $1/2$ mm. *Flowers* pure white with yellow

limb, prominently 3-winged, 3–7 mm. Outer perianth lobes triangular, subobtusate, with swollen margin, about 1 mm. Inner ones orbiculate, minute. Perianth tube cylindrical-trigonus to conical-trigonus, about 2½ mm. Connective quadrangular, with a broad, obtuse, basal hanging spur and crowned by 2 short, thick, straight, obtuse, divergent crests. Style thick-filiform, bearing 3 sessile, slightly curved, bilabiate, funnel-shaped stigmas. Ovary subglobose, about 2 mm. Flower wings half elliptical to half-quadrangular, pure white, about 4½ by 1½ mm. Capsule subglobose, dehiscent with transverse slits. Seeds scobiform.

Distr. *Malaysia*: E. Java, Paseroean Residency (Mt Lamongan).

Ecol. Collected on the SW. slope of Mt Lamongan on coarse, volcanic sandy soil in brushwood, ca 600 m alt. It is the only species of the family hitherto reported from East Java.

14. *Burmattia lutescens* BECC. Malesia 1 (1877) 246; JONKER, Monogr. (1938) 24, 148.—*Gonyanthes candida* BLUME, Cat. Gew. Buitenzorg (1823) 20.—*Gonyanthes candida* BLUME, Flora 8 (1825) 123.—*B. candida* (BL.) ENGL. Nat. Pfl. Fam. 2,6 (1889) 50, not *B. candida* GRIFF. ex HOOK. f.—*B. gracilis* RIDL. J. Str. Br. R. As. Soc. 22 (1890) 335.—*B. papillosa* STAFF, Trans. Linn. Soc. II, 4 (1894) 232.—*B. novae-hiberniae* SCHLTR. in K. SCH. & LAUT. Nachtr. Fl. D. Sch. Geb. (1905) 73.—*B. gjellerupii* J.J.S. in FEDDE, Rep. 10 (1912) 487.—*B. gonyantha* HOCHR. Candollea 2 (1925) 325.—Fig. 9–10.

Saprophyte, up to 23 cm. Stem thickly filiform to robust, simple or branched, 1-flowered or forked into the inflorescence. Leaves lanceolate to ovate, acute, 1–3½ mm. Bracts lanceolate to ovate, often keeled and carinate. Cincinni bifid, up to 11-flowered; branches up to 3 cm. Flowers pedicellate, white, sometimes with yellow limb, seldom bluish, about 8½ mm. Outer perianth lobes ovate or triangular, apiculate, about 1½ mm; margin fleshy. Inner lobes minute, fleshy, orbiculate. Perianth tube trigonous, 2½–5 mm. Connective truncate, rounded at the base, slightly 2-lobed at the apex into 2 very short, papillose crests. Basal spur absent. Style thick, bearing 3 subsessile, funnel-shaped to bowl-shaped stigmas. Style with stigmas as long as the tube. Ovary subglobose to truncate-globose, 3–5 mm. Flower wings various, linear, or elliptical, or rather broad, half-cuneate or quadrangular, running from the base of the limb to the middle or the base of the ovary. Capsule subglobose, dehiscent with large horizontal slits.

Distr. *Malaysia*: Sumatra, Malay Peninsula, Borneo, Java, New Guinea, and New Ireland.

Ecol. Usually in the humus of shady moist forests, up to 1500 m.

Notes. Specimens with narrow perianth wings have been described as *B. lutescens*, *B. novae-hiberniae*, *B. gjellerupii*, with elliptical ones as *Gonyanthes candida*, and rather broad-winged speci-

mens as *B. gracilis*. They all belong to one species variable in that respect. In Java the species was often called *B. candida* (BL.) ENGL. but this is a later homonym; *B. candida* GRIFF. ex HOOK. f. is



Fig. 10. *Burmattia lutescens* BECC., Mt Salak, W. Java. Form with narrow perianth wings, $\times 2/3$.

an allied species, occurring in Burma, Siam and the Langkawi Islands.

15. *Burmattia malasica* JONKER, Monogr. (1938) 152.—*Burmattia lutescens* (non BECC.) WINKLER, Bot. Jahrb. 48 (1913) 96.

Saprophyte, 5½–8 cm. Stem simple, 1-flowered, seldom 2-flowered, beset with few appressed, lanceolate, subacute, 1-veined, slightly keeled, 1½–2 mm long, scale-like leaves. Bracts elliptical, acuminate, 1-veined, 1½ mm. Flowers purple or white with yellow limb, prominently winged, about 5 mm. Outer perianth lobes triangular with swollen margin, acuminate to apiculate, about 1 mm. Inner lobes erect, lanceolate-ovate, obtuse, about ½ mm. Perianth tube cylindrical, 1½ mm. Connective obtriangular, obtuse at the base, provided with 2 short, divergent crests at the apex. Style cylindrical, bearing 3 sessile, funnel-shaped stigmas. Ovary subglobose to ellipsoid, 2½ by 2 mm. Flower wings half-orbiculate to half-elliptical, about 4 by 2 mm. Capsule ellipsoid to obovoid, dehiscent with a transverse slit. Seeds scobiform to fusiform.

Distr. S. Siam and *Malaysia*: SE. Borneo.

2. GYMNOSIPHON

BLUME, Enum. Pl. Jav. I (1827) 29; JONKER, Monogr. (1938) 27, 168.

Saprophytic annuals, without chlorophyll. *Leaves* scale-like. *Perianth* limb consisting of 6 lobes, the 3 outer being much larger and slightly 3-lobed. Anthers 3, sessile in the throat. Thecae bursting horizontally. Ovary ovoid to globose, 1-celled with 3 parietal placentas, each placenta provided with a large, globose gland at both sides of the top. Style filiform, branching into 3 short branches, each bearing a stigma. *Perianth* limb, stamens and the upper part of style with the stigmas caducous after flowering. *Capsule* crowned by the persistent perianth tube. Seeds ovoid to globose, reticulate.

Distr. 29 species, tropics of both hemispheres, not in Australia.

Notes. In Asia, and Malaysia, this genus is represented by the section *Eugymnosiphon* URBAN only, characterized by the reticulate-perforated capsule dehiscing at the top.

KEY TO THE SPECIES

1. Anthers inserted above the middle of the perianth.
2. Flowers pedicellate, in loose, many-flowered cincinni or bifid cincinni 1. *G. aphyllus*
2. Flowers \pm sessile in a 1- or sparsely flowered inflorescence.
3. Capsule \pm globose. Margin lobes of the outer perianth lobes crenate 2. *G. oliganthus*
3. Capsule conical-ovoid. Margin lobes of the outer perianth lobes entire 3. *G. minahassae*
1. Anthers inserted in or below the middle of the perianth.
4. Anthers inserted below the middle of the perianth. Connective apiculate at the top. Ovary elongate-conical, tapering to the pedicel 4. *G. affinis*
4. Anthers inserted in the middle of the perianth. Connective not apiculate. Ovary marked from the pedicel.
5. Flowers sessile or subsessile in loose cincinni or bifid cincinni 5. *G. papuanus*
5. Stem 1-2-flowered, or many sessile flowers in a capitate inflorescence at the top of the stem.
6. Outer perianth lobes acuminate, a third of the length of the whole perianth. Connective narrow. Stigmas with dorsal crest. Inflorescence 2- to many-flowered 6. *G. neglectus*
6. Outer perianth lobes deltoid, short, a fifth of the whole perianth. Stigmas without crest. Inflorescence 1-3-flowered 7. *G. pauciflorus*

1. *Gymnosiphon aphyllus* BLUME, Enum. Pl. Jav. I (1827) 29; JONKER, Monogr. (1938) 30, 170.—*G. borneense* BECC. Malesia I (1877) 241.—*G. pedicellatum* SCHLTR. Bot. Jahrb. 49 (1913) 105.—Fig. 7.

Stem up to 17 cm, forked into a bifid cincinnus or bearing a simple cincinnus. *Leaves* acute, often keeled, appressed, 1-2½ mm. Bracts ovate, obtuse, scale-like. Pedicels 1-5 mm. Inflorescence often loose and many-flowered. *Perianth* white or lilac; tubular part up to 4 mm; limb about 2½ mm. Outer perianth lobes ovate, obtuse, provided with a narrow, crenate lateral lobe at both sides. Inner ones linear-lanceolate, minute. Stigmas curved, funnel-shaped, inappendiculate. *Capsule* about 3 mm.

Distr. S. Siam, throughout *Malaysia*.

Ecol. On humus or decaying wood or leaves in the shade of moist forests, below 1500 m alt.

2. *Gymnosiphon oliganthus* SCHLTR. Bot. Jahrb. 49 (1913) 101; JONKER, Monogr. (1938) 172.

Stem tender, simple or branched, 4-9½ cm, 1- or 2-flowered. *Leaves* and bracts minute, to 1 mm, keeled and appressed. Pedicels up to 3 mm. *Flowers* white to bluish lilac, up to 5 mm. Outer perianth lobes triangular, subobtuse, provided with crenate lateral lobes. Inner ones small, cuneate, obtuse to truncate. Stigmas auriculate, soup-plate-shaped.

Distr. *Malaysia*: NE. Brit. New Guinea, once collected.

Ecol. In forests, 450 m alt.

3. *Gymnosiphon minahassae* SCHLTR. Bot. Jahrb. 49 (1913) 104; JONKER, Monogr. (1938) 172.

Stem usually simple, 2-5-flowered, 7-12 cm. *Leaves* acute, appressed, up to 1 mm. Bracts more or less obtuse, keeled. Pedicels 1-3 mm. *Perianth* white with bluish limb. Outer perianth lobes obtuse; lateral lobes entire. Inner ones lanceolate. *Perianth* limb deciduous above the anthers. Stigmas quadrangular, truncate at the apex, apiculate at the base.

Distr. *Malaysia*: N. Celebes (Minahasa), once collected.

Ecol. In humic soil, 800 m alt.

4. *Gymnosiphon affinis* J.J.S. Nova Guinea 8 (1909) 194; JONKER, Monogr. (1938) 31.—*G. torricellense* SCHLTR. Bot. Jahrb. 49 (1913) 101.

Stem 7-13 cm, simple or branched, white, lilac or rose-coloured, forked into a bifid cincinnus or bearing a simple cincinnus of 1-3 flowers. *Leaves* ovate, acuminate, 1-2 mm. Bracts to 3 mm. Pedicels 1-4 mm. *Perianth* white, limb 2½ mm, tube 1½ mm. Outer perianth lobes ovate, obtuse; lateral lobes crenate. Inner ones small, rather broad,

obovate, obtuse. Tube swollen at the insertion of the stamens. Connective quadrangular, acute-apiculate at the apex. Stigmas rather large, soup-plate-shaped. Ovary obconical, swollen in the upper part, about 1½ mm. *Capsule* thick-ellipsoid, about 3–3½ mm, crowned by the short, cylindrical to conical, 2 mm long, persistent part of the tube. Seeds brownish, fusiform, reticulate.

Distr. *Malaysia*: New Guinea.

Ecol. In forests, in humic soil, ascending to ca 700 m alt.

5. *Gymnosiphon papuanus* BECC. Malesia 1 (1877) 241; JONKER, Monogr. (1938) 174.—*G. celebicum* SCHLTR. Bot. Jahrb. 49 (1913) 104.

Stem simple or branched, 4–14 cm, colourless, bearing rather loose simple or bifid cymes of 3-many subsessile flowers. *Leaves* acuminate, up to 2½ mm. Bracts up to 3½ mm. *Perianth* whitish-purplish; limb about 1½ mm; tube up to 4½ mm. Outer perianth lobes ovate, triangular, obtuse; lateral lobes entire, involute. Inner ones small, linear. Connective deltoid, at the top 3-lobed, provided with a forked thickening. Stigmas rather large, soup-plate-shaped, obtuse, cordate, auriculate at the base. Ovary ovoid, about 1½ mm. *Capsule* obovoid to truncate-subglobose, 2½–5 mm long; crowned by the 2–2½ mm long, cylindrical persistent part of the tube.

Distr. Micronesia (Palau Islands), in *Malaysia*: Celebes and New Guinea.

Ecol. Moist forests, in humic soil, ascending to ca 500 m alt.

6. *Gymnosiphon neglectus* JONKER, Monogr. (1938) 175.

Stem simple or branched, 7½–11 cm, bearing 1 or few flowers or a capitate inflorescence, consisting of contracted cymes. *Leaves* lanceolate-ovate, acuminate, keeled, 1–2½ mm. Bracts to 5 mm. *Flowers* subsessile. *Perianth* dirty white; tube about 2 mm; limb about 2 mm. Outer perianth lobes ovate, acuminate; lateral lobes crenate. Inner ones small, linear, acute. Stigmas funnel-shaped, curved, dorsally cristate. Ovary ovoid, about 2 mm. *Capsule* nearly globose, crowned by the 2 mm long persistent part of the tube.

Distr. *Malaysia*: Java (Preanger Regencies and Semarang).

Ecol. Moist forests, ascending to 1000 m alt.

7. *Gymnosiphon pauciflorus* SCHLTR. Bot. Jahrb. 49 (1913) 102; JONKER, Monogr. (1938) 176.

Stem simple, colourless, 2½–9½ cm, bearing 1–3 sessile or subsessile flowers. *Leaves* ovate, acuminate, 1–1½ mm. Bracts to 3 mm. *Perianth* whitish to purplish; tube about 4 mm; limb very short. Outer perianth lobes ovate, acute, about 1–1½ mm; lateral lobes entire. Inner ones minute. Connective not apiculate, forked at the top. Style branches rather long, each bearing an ovoid, in transverse section somewhat triangular, stigma. Ovary obovoid, about 2 mm. *Capsule* ovoid, to 3½ mm; persistent part of the tube 1½–2½ mm.

Distr. *Malaysia*: New Guinea (Kani Mts), once collected.

3. THISMIA

GRIFFITH, Proc. Linn. Soc. 1 (1844) 221; JONKER, Monogr. (1938) 42, 227.

Saprophytic, fleshy herbs. Underground part in the Malaysian species coralliform or vermiform and creeping. Stems usually short, seldom branched. *Leaves* small, scale-like. Below the flowers 1 or more bracts, sometimes forming an involucre. Flowers actinomorphic or, sometimes, zygomorphic, urceolate to campanulate. *Perianth* lobes 6, occasionally free and of equal length and size, or inner ones larger, sometimes inner lobes connivent at the apex or connate in the apical part, then forming an erect mitre with 3 holes, in that case outer lobes very small. Stamens 3, free or, usually, stuck together to an anther tube, hanging at an annulus in the perianth throat. Filaments short, ribbon-shaped. Style thick, short, cylindrical or conical, persistent, bearing at its apex 3 simple or bilabiate stigmas. Ovary obconical or obovoid; the 3 placentas inserted at the bottom or parietally in the basal part of the ovary. *Fruit* fleshy, cup-shaped, crowned by the persistent, fleshy, basal ring of the perianth tube and the style with the stigmas.

Distr. 24 species, in tropical America (*Sect. Myostoma* and *Ophitomeris*), tropical Asia (*Sect. Euthismia* and *Sarcosiphon*), Chicago area, New Zealand and Tasmania (*Sect. Rodwaya*).

KEY TO THE SPECIES

1. Inner perianth lobes free, spreading or erect. Underground part vermiform, creeping (SECT. *Euthismia* SCHLTR.)
2. Perianth lobes equal in length and size (SUBSECT. *Odoardo* SCHLTR.)
3. Flowers zygomorphic, geniculate 1. *T. chrysops*
3. Flowers actinomorphic.
4. Stems several, flowers 4-6 in a raceme 2. *T. racemosa*
4. Stem simple; flowers usually 1-3, terminal.
5. Leaves and bracts beset with distinct, prominent, blunt processes 3. *T. grandiflora*
5. Leaves and bracts without processes.
6. Perianth lobes lanceolate, acute to acuminate, flat 4. *T. fumida*
6. Perianth lobes triangular at the base, tapering into long, filiform tentacles.
7. Perianth tube with horizontal bars inside. Stigmas lanceolate.
8. Anthers provided with 3 thick-filiform appendages at the free apical margin. Perianth yellowish in the basal part, bright orange-yellow in the upper part and limb. Tentacles bright orange-red at the base. Perianth lobes with tentacles up to 10 mm 5. *T. aseroe*
8. Anthers with 1 thick-filiform, median appendage and 2 lateral, short teeth at the free apical margin. Perianth white with 6 ochre-brown streaks; lobes with tentacles c. 20 mm 6. *T. alba*
7. Perianth tube without bars. Apical margin of the anthers with 2 teeth, each bearing a globose body at the top. Stigmas funnel-shaped with prominent margin 7. *T. ophiuris*
2. Inner perianth lobes larger (SUBSECT. *Brunonithismia* JONK.)
9. Perianth very zygomorphic, bilabiate. Upper lip fleshy, bent over the opening of the tube 8. *T. labiata*
9. Flowers actinomorphic.
10. Inner perianth lobes simple. Tube with prominent horizontal bars inside.
11. Anthers with 3 distinct teeth at the free apical margin, each tooth bearing a stiff hair. Outer perianth lobes broadly ovate, obtuse, erect 9. *T. javanica*
11. Anthers slightly dentate apically. Outer perianth lobes short, ear-shaped 10. *T. arachnites*
10. Inner perianth lobes consisting of 3 parts. Basal part erect, short, bearing the transverse part, hamate at the base and broadened at the apex. Third part awl-shaped, inserted on the broad apex of the second part. Perianth tube without bars 11. *T. neptunis*
1. Inner perianth lobes connected at the apex to an erect mitre with 3 holes. Underground part coraliform (SECT. *Sarcosiphon* (BL.) JONK.)
12. Inner perianth lobes linear, connate at the tips, forming a mitre with large holes. Anthers ciliate in the basal part, toothed at the apex.
13. Apical margin of the anthers provided with 2 teeth, each bearing a stiff hair. Anthers slightly constricted in the middle, below the thecae 12. *T. clandestina*
13. Apical margin of the anthers provided with 3 teeth, each bearing a stiff hair. Anthers constricted at the base, just above the thecae 13. *T. episcopalis*
12. Inner perianth lobes spatulate, connate to a mitre with rather small holes. Anthers not ciliate, truncate at the apex 14. *T. crocea*

1. *Thismia chrysops* RIDL. Ann. Bot. 9 (1895) 323; JONKER, Monogr. (1938) 237.

Stem usually simple and 1-flowered, about 15 cm. *Leaves* and bracts linear-lanceolate, acute more or less imbricate, up to 4 mm. *Perianth* tube geniculate; part below knee c. 3 mm, pink with longitudinal striae; the c. 5 mm long, upper part and limb chocolate-brown; perianth mouth yellow. Perianth lobes lanceolate, about 7 mm, tapering to filiform tentacles. Annulus prominent, slightly 6-lobed. Anthers quadrangular, provided with a thick hair on both sides of the free, apical margin and a broad, wing-like appendage, inserted on the midline of the connective. Stigmas oblong, bifid. *Fruit* stalk elongate.

Distr. *Malaysia*: Malay Peninsula (Malacca, Mt Ophir), once collected.

2. *Thismia racemosa* RIDL. J. Str. Br. R. As. Soc. 69 (1915) 13; JONKER, Monogr. (1938) 238.

Stems several, occasionally branched. *Leaves* linear, acuminate. *Flowers* 4-6 in a raceme; pedicels

1-1½ cm long. Perianth lobes short, triangular-ovate, blunt. Annulus prominent. Tube cylindrical, about 6 mm long.

Distr. *Malaysia*: Malay Peninsula (Pahang), once collected.

3. *Thismia grandiflora* RIDL. Ann. Bot. 9 (1895) 324; JONKER, Monogr. (1938) 239.

Stem simple, 1-flowered, 3 cm, provided with 2 basal, opposite, scale-like lanceolate *leaves*, about 5 mm, and 2 apical bracts, of the same shape and size as the basal leaves; both leaves and bracts beset with stiff, terete, blunt processes on the back. *Perianth* urceolate; tube pink with longitudinal striae, 8 mm. Lobes patent, ovate-triangular in the basal part, tapering at the apex to filiform tentacles. Annulus prominent. Anthers not or scarcely stuck together, provided with 2 lateral teeth at the free apical margin and a wing-like appendage inserted at the middle of the connective. Stigmas lanceolate, bifid, acute, papillose. Ovary about 4 mm, obovoid, truncate.

Distr. *Malaysia*: Malay Peninsula (Johore), once collected.

4. *Thismia fumida* RIDL. J. Str. Br. R. As. Soc. 22 (1890) 338; JONKER, Monogr. (1938) 240.

Stem slender, conspicuous, unbranched, about 10 cm, bearing 1–2 flowers. *Leaves* very small, appressed, lanceolate, acute. *Flowers* up to 1 cm. Perianth lobes lanceolate, acute, greenish-grey, constricted above the ovary and broadened below the limb, white with pink stripes. Annulus prominent. Ovary obconical. *Capsule* cup-shaped, ribbed and scabrid, crowned by the crenulate, basal ring of the perianth.

Distr. *Malaysia*: Malay Peninsula (Singapore and Selangor).

5. *Thismia aseroe* BECC. Malesia I (1877) 252; JONKER, Monogr. (1938) 240.—Fig. 3.

Stem simple or, sometimes, branched, 1- or 2-flowered, up to 8½ cm high. *Leaves* few, lanceolate, obtuse, to 4 mm long. At the base of the flowers an involucre, consisting of lanceolate bracts. Perianth obconic-campanulate, dirty-yellow in the basal part, bright orange-yellow in the upper part and in the limb. *Perianth* tube about 11 mm; the basal 5 mm inside with transverse bars. Lobes triangular, 3 mm long, ending in bright orange tentacles, red at the base, 6 mm long. Annulus prominent. Anthers with 3 short thick-filiform appendages at the free apical margin; in the lower part of the anther, inserted at the middle of the connective, a broad, dorsal quadrangular wing, wider than the anther. Thecae oblong, in the basal part of the anther; in the apical part 2 nectaries on the line of junction of one connective with the next. Ovary obovoid, 3 mm. Stigmas narrow-lanceolate, rather long, acute. *Capsule* ribbed, about 5 mm. Fruit stalk lengthening about 5–7 mm above the involucre. Seeds ellipsoid, ribbed.

Distr. *Malaysia*: Malay Peninsula (Singapore and Perak).

Ecol. In humid forests.

6. *Thismia alba* HOLTUM, ms.

A Th. aseroe differt antheris singulis munitis una tantum appendice mediana crassi-filiformi, porro margine apicali libera instructa dentibus 2 lateralibus brevibus. Perianthium album signatum striis 6 longitudinalibus ochraceo-brunneis; perianthii lobis tentaculis ± 2 cm longis praeditis.

Stem simple, 1- to 3-flowered, up to 10 cm. *Leaves* few, 3–4½ mm long, lanceolate, acute or acuminate. At the base of the flowers an involucre, consisting of lanceolate, acute bracts. *Perianth* obconic-campanulate, white with 6 thin ochraceous-brown streaks, leading down from each perianth lobe, alternating with 6 thin yellow lines. *Perianth* tube about 10 mm, the basal part with transverse bars inside. Lobes triangular, 3–4 mm long, pale-yellow at the base, terminated by white, tentacles about 15 mm long. Annulus prominent, bright yellow. Anthers with 1 thick-filiform, median appendage and 2 lateral short teeth at the free apical margin; in the lower part of the anther, inserted

at the middle of the connective, a broad, dorsal, quadrangular wing, wider than the anther. Thecae oblong, in the basal part of the anther; in the apical part 2 nectaries on the line of junction of one connective with the next. Ovary semi-globose, about 2 mm. Stigmas lanceolate, retuse, papillose. *Capsule* obconical, about 6 mm.

Distr. *Malaysia*: Malay Peninsula (Pahang).

7. *Thismia ophiuris* BECC. Malesia I (1877) 252; JONKER, Monogr. (1938) 242.

Stem 2–6 mm, simple or branched, 1- or 2-flowered. *Leaves* lanceolate, obtuse, to 4 mm long. Below the flowers an involucre of several, lanceolate, 3–4 mm long and 1 mm wide bracts. *Perianth* urceolate, yellowish brown. Tube about 9 mm; lobes triangular, terminated by long, filiform tentacles, about 13 mm. Annulus broad and thick. Insertion of the stamens broad, then narrowed into a ribbon-shaped filament and again broadened into the quadrangular anthers. Apical free margin of the anthers provided with 2 teeth, each with a globose body at the top. Ovary ovoid, about 5 mm. Style bearing 3 sessile, funnel-shaped, circumvalated stigmas. *Capsule* ribbed; seeds oblong with longitudinal ribs; funicles about the same length as the seeds.

Distr. *Malaysia*: Borneo (Sarawak & Br. N. Borneo).

8. *Thismia labiata* J.J.S. Bull. Jard. Bot. Btzg III, 9 (1927) 220; JONKER, Monogr. (1938) 44, 243.

Stem simple, 22 mm long. *Leaves* ovate, acute, appressed, 1½ mm. Flowers with an involucre of 3 ovate-lanceolate, acute, 5½ mm long bracts. *Perianth* urceolate in the basal part, bilabiate-zygomorphous in the upper part. Outer perianth lobes 2½ mm, broad-ovate at the base, rounded, with a subulate appendage inserted below the top. Inner lobes linear to filiform, subulate, 5 mm. A thick, fleshy upper lip bent over the perianth mouth; on the back of the upper lip 1 inner and 2 outer perianth lobes. The other 2 inner lobes between the 2 lips. The third outer lobe inserted on the middle of the lower lip. Stamens rounded and ciliate at the free, apical margin; thecae elongate; outer side of the stamen provided with scattered hairs. The 3 stigmas connate to a capitate, 3-lobed stigma. Ovary obconical.

Distr. *Malaysia*: Sumatra (Eastcoast Res.) once collected.

9. *Thismia javanica* J.J.S. Ann. Jard. Bot. Btzg 23 (1910) 32; JONKER, Monogr. (1938) 245.—Fig. 11.

Stem simple or branched, up to 12 cm, 1- to 5-flowered. *Leaves* ovate or lanceolate-ovate, obtuse, 3 mm. At the base of a flower an involucre of 3 bracts. *Perianth* tube 7 mm, urceolate, whitish with 12 longitudinal, orange stripes, inside with longitudinal bars connected by many transverse bars. Outer perianth lobes obtuse, ovate; inner ones triangular, terminated in up to 3 cm long, filiform tentacles. Anthers 3-toothed at the free apical margin; each tooth terminating in a hair. On the outer side of the anther, inserted in the middle, a qua-

drangular appendage, wider than the stamen. Margin of the appendage strigose. Style orange-coloured; stigmas sessile, ovate, truncate. Ovary obovoid, 3 mm. *Capsule* orange-coloured, about 6 mm. Seeds ellipsoid.

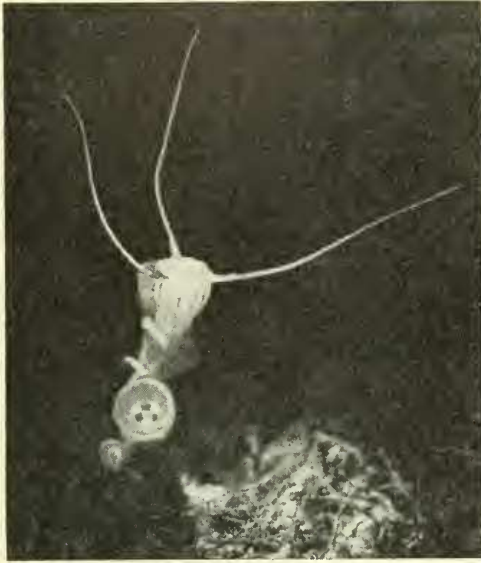


Fig. 11. *Thismia javanica* J. J. S. Doengoes Iwoel, $\times \frac{1}{2}$. (LIEFTINCK)

Distr. *Malaysia*: Sumatra and W. Java.

Ecol. Shade of forests, on humus, below 1000 m alt.

Vern. *Angkrek rambut* (Java).

Notes. Perhaps conspecific with the following species.

10. *Thismia arachnites* RIDL. Journ. Str. Br. Roy. As. Soc. 44 (1905) 197; JONKER, Monogr. (1938) 247.

Stem simple, 1–7½ cm, bearing 1–3 flowers. *Leaves* few, lanceolate, acute, about 5 mm. At the base of the flowers an involucre, consisting of ovate-lanceolate, acute, 5–7 mm long bracts. *Perianth* urceolate to obconical, about 8 mm long, inside with longitudinal bars, connected by many transverse bars; tube transparent, white with 6, vertical, red streaks in the apical part. *Perianth* lobes pale red. Outer lobes very short, about ½ mm, ear-shaped; inner ones triangular, about 1 mm, terminating in up to 3 cm long, thin, filiform tentacles. Annulus prominent, yellow. Anthers slightly 3-toothed at the apical free margin, the lateral teeth somewhat larger than the median one, each tooth terminating in an indistinct, very thin, fragile hair. On the outer side of the anther, inserted in the middle, a quadrangular strigose appendage, wider than the stamen. Style thick, conical; stigmas lanceolate, obtuse. Fruit stalk lengthening above the involucre.

Distr. *Malaysia*: Malay Peninsula (Perak & Pahang).

Note. Closely related to the preceding species, perhaps conspecific.

11. *Thismia neptunis* BECC. *Malesia* I (1877) 251; JONKER, Monogr. (1938) 43, 243.

Stem 4–25 mm, simple, 1-flowered, beset with few, lanceolate, acute, about 3 mm long *leaves*. At the base of the flower an involucre of 3 lanceolate, acute, 4–6 mm long bracts. *Perianth* tube urceolate, with 6 longitudinal stripes, 6 mm. Outer perianth lobes simple, recurved, filiform with triangular base, 4½ mm. Inner ones erect, about 15 mm, consisting of an erect, short, basal part; a transverse part with hamate base and a broadened, rounded apex and, inserted on the apex of the transverse part, an erect, long, awl-shaped part. Annulus prominent. Anther quadrangular, 3-toothed at the free apical margin. Stigmas lanceolate, acute. Ovary obovoid, truncate, 1½ mm.

Distr. *Malaysia*: Borneo (Sarawak, Mt Matang), once collected.

12. *Thismia clandestina* (BL.) MIQ. *Fl. Ind. Bat.* 3 (1855) 616; JONKER, Monogr. (1938) 252.—*Sarcosiphon clandestinus* BL. *Mus. Bot. Lugd. Bat.* 1 (1849) 65.

Stem up to 5 cm, 1–2-flowered. *Leaves* appressed, acuminate, to 5 mm. At the base of the flower 3 bracts. *Perianth* tube urceolate, about 2½ mm, greenish-grey, with 12 longitudinal, brownish-black stripes. Outer perianth lobes almost absent, inner ones connate to a 2½ mm long, acuminate mitre. Annulus prominent, 6-lobed. Margin of the filaments and upper part of the anthers with short hairs. Thecae oblong, inserted on the margins of the anthers. Free apical margin of the anthers with 2 teeth, tapering to stiff hairs. Inserted on the midline a large, wing-like appendage, provided with bundles of hairs on the angles. Stigmas ovate, bilobate, papillose, whitish. Ovary obovoid, about 3 mm. Funicle about the same length as the ovules. *Capsule* papillose, about 5 mm.

Distr. *Malaysia*: W. Java.

Ecol. In humus of forests, ascending to ca 1000 m alt.

13. *Thismia episcopalis* (BECC.) F. v. MUELL. *Pap. & Proc. R. Soc. Tasm.* for 1890 (1891) 235; JONKER, Monogr. (1938) 46, 253.—*Geomitra episcopalis* BECC. *Malesia* I (1877) 250.—*Bagnisia episcopalis* ENGL. *Pfl. Fam.* 2, 6 (1889) 48.—*Sarcosiphon episcopalis* SCHTR. *Notizbl.* 8 (1921) 38.—Fig. 4.

Stem simple or branched, 1–8 flowered, up to 19 cm. *Leaves* appressed, ovate, acute, 2–5 mm. *Perianth* tube urceolate, yellow with black stripes, 6–9 mm. Outer perianth lobes almost lacking; inner connate to a slightly acuminate, about 5 mm long mitre. Filaments constricted. Thecae divergent. Margin of the anthers and the winglike appendage hairy, apical part of the anther, below the insertion of the appendage, darker coloured; free apical margin 3-toothed, each tooth terminated by a stiff hair. Stigmas bilobate. Ovary obovoid, 3 mm. Funicles about as long as the ovules. *Capsule* ribbed, about 3 mm. Fruit stalk lengthened.

Distr. *Malaysia*: Borneo (Sarawak, Br. N. Borneo).

Ecol. In humus of forests, ascending to ca 1700 m alt.

14. *Thismia crocea* (BECC.) J.J.S. Nova Guinea 8, 1 (1909) 193; JONKER, Monogr. (1938) 44, 251.—*Bagnisia crocea* BECC. Malesia 1 (1877) 249.—*Thismia versteegii* J.J.S. Nova Guinea 8, 1 (1909) 193.—*Sarcosiphon croceus* SCHLTR. Notizbl. 8 (1921) 38.—*Sarcosiphon versteegii* SCHLTR. Notizbl. 8 (1921) 38.

Stem simple, 1–3-flowered, about 6 cm. *Leaves* appressed in the basal part, lanceolate, acute, to 6 mm. At the base of the flowers 3 ovate lanceolate, acute bracts. *Perianth* tube urceolate, ribbed, reddish-brown in the upper part, yellowish-orange in the middle and white at the base, about 6 mm.

Outer *perianth* lobes broad, short, rounded; inner ones connate to a thick, 2 mm long mitre with 3 narrow holes and 3 prominent midribs. Annulus slightly 12-lobed. Anthers quadrangular, not hairy; thecae oblong, parallel; inserted in the apical part of the anther a broad appendage with curled margins. Stigmas ovate, obtuse, papillose. Ovary light reddish-brown, about 2 mm. Funicles as long as the ovules. *Fruit* ribbed, obovoid. Fruit stalk thickened and lengthened after flowering to 16 mm above the bracts.

Distr. *Malaysia*: West New Guinea.

Notes. In Perak (Malay Peninsula), RIDLEY observed a *Thismia*, described by him in Mat. Fl. Mal. Pen. 2 (1907) 75, as *Bagnisia crocea* var. *brunnea*. This specimen was apparently not preserved; it is highly improbable that it belongs to *T. crocea*.

4. GEOMITRA

BECCARI, Malesia 1 (1877) 250; JONKER, Monogr. (1938) 46, 254.

Underground part unknown. Stem beset with scale-like *leaves*. *Flowers* rather large, with an involucre at the base. Tubular part of the *perianth* urceolate. Outer *perianth* lobes free, very small. Inner ones connate at the top to an erect mitre with 3 holes, crowned by 3 apical, long, thick-filiform, erect, clavately swollen appendages. Basal ring of the *perianth* tube thickened, persistent on the fruit. Throat margin of the *perianth* thickened to a 6-lobed annulus. Stamens 6, hanging at the annulus; anthers stuck together to a tube. Style short, cylindrical, fleshy, bearing 3 erect stigmas. Ovary with 3 stalked placentas; funicles short. *Capsule* cup-shaped, crowned by the persistent, basal *perianth* ring and the style.

Distr. One species, known only from Borneo (Sarawak).

1. *Geomitra clavigera* BECC. Malesia 1 (1877) 251; JONKER, Monogr. (1938) 46, 255.—*Thismia clavigera* F. v. MUELL. Vict. Nat. (1890) 235.—*Sarcosiphon clavigera* SCHLTR. Notizbl. 8 (1921) 39.

Stem simple, up to 12 cm, bearing about 3 flowers. *Leaves* lanceolate, acuminate or acute, 2–6 mm. Bracts lanceolate, acuminate, 6–7 mm. *Perianth* tube about 9 mm. Outer *perianth* lobes erect, broadly triangular, about 1 mm. Mitre about

3–5 mm, hooked at the apex. Filiform appendages 8–12 mm long. Anthers quadrangular; free apical margin with 3 teeth, each bearing a stiff, transparent hair. Anther tube about 4 mm. Stigmas lanceolate, bilobate; lobes acute. Ovary obovoid, truncate, about 3 mm.

Distr. *Malaysia*: Borneo (Sarawak), once collected.

5. SCAPHIOPHORA

SCHLTR. Notizbl. 8 (1921) 39; JONKER, Monogr. (1938) 46, 256.

Roots coralliform. Stem provided with scale-like *leaves*; at the base of the flower an involucre. *Perianth* tube urceolate. Outer *perianth* lobes small; inner ones narrow in the basal part, broadened at the apical part, connate to an erect mitre with 3 holes in the basal part. Mitre crowned by a long, stiff column, bearing at the top 3 lobes. Stamens 6, hanging, inserted at an annulus in the *perianth* throat. Filaments ribbon-shaped. Anthers stuck together to an anther tube; each anther provided with a wing-like appendage, inserted in the middle and broader than the anther. Placentas stalked; stalks inserted peripherically at the bottom of the ovary. Basal *perianth* ring and style persistent on the *fruit*.

Distr. Two species, one in New Guinea, the other in the Philippines.

KEY TO THE SPECIES

1. Flowers 3–6½ cm long (without column). Column 1½–6 cm long, at the apex broadened to 3 fleshy, connate lobes 1. *S. gigantea*
 1. Flowers 1 cm long (without column). Column 5 mm long, bearing at the apex 3 cup-shaped bodies 2. *S. appendiculata*

1. *Scaphiophora gigantea* JONKER, Monogr. (1938) 257.—Fig. 2.

Stem 4–10½ cm, partly subterranean. *Leaves* lanceolate, acute, 2–4 mm, the lower ones keeled. Bracts ovate, lanceolate, acute, about 18 mm. *Perianth* tube 15–21 mm, pale rose-coloured with yellow veins, reticulate below the inner perianth lobes. Outer perianth lobes ear-shaped. Mitre 5–9 mm long, orange to yolk-yellow. Stamens about 7 mm. Anthers prominently nerved; free apical margin provided with 3 median and 2 lateral teeth; each bearing a stiff, transparent hair. Appendix of the anther greenish-blue; lateral margins bearing 3 bundles of short hairs; apical margin pilose. Thecae divergent, ovate. Style truncate-conical. Stigmas sessile, obovate, 2-lobed, papillose outside and in the upper part inside. *Fruit* cup-shaped. Placentas connate at the apex, stalked; stalks about the same length as the placentas.

Distr. *Malaysia*: Philippines (Luzon), twice collected.

2. *Scaphiophora appendiculata* (SCHLTR.) SCHLTR. Notizbl. 8 (1921) 39; JONKER, Monogr. (1938) 259.—*Thismia appendiculata* SCHLTR. Bot. Jahrb. 55 (1918) 202.

Stem 15–20 mm high, partly subterranean, usually 1-flowered. *Leaves* ovate to lanceolate, 2–3 mm. Bracts lanceolate, acute, about 5 mm. *Perianth* tube 6 mm, yellowish white in the lower part. Outer perianth lobes small, ear-shaped. Mitre 3–6 mm, orange-coloured. At the base of each perianth lobe, on the inner side, a glandular, bowl-shaped body. Column ± broadened towards the apex, bearing 3 thick, fleshy, cup-shaped bodies. Stamens about 3 mm. Appendage of the anther crenulate at the apical margin. Thecae divergent. Style truncate-conical, 1½ mm. Stigmas sessile, obovate, 2-lobed, 1 mm. Ovary 3½ mm. Placentas stalked, above the fertile part suddenly narrowed again into a filiform, apical appendage. Placentas attached to the bottom of the ovary by the stalks and to the roof by the apical appendages.

Distr. *Malaysia*: Northeast New Guinea, once collected.